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ABSTRACT

This syllabus, which is the first of a two-volume set describing the basic competencies needed by entry-level workers in the field of electronics, deals with the basic theories of electricity and electronics. Competencies are organized according to the following skills areas: the meaning of electricity, how electricity works, resistors, Ohm's law, electrical symbols, series circuit principles, parallel and series-parallel circuits, electrical currents, electrical measurement, solid-state devices, and electronics vocabulary. Each page in the syllabus presents a competency statement that is defined by an indicator, a performance objective, a benchmark, and one or more specific observable tasks or behaviors to be used as assessment criteria. Thirteen vocabulary quizzes and an answer key are appended. (MN)

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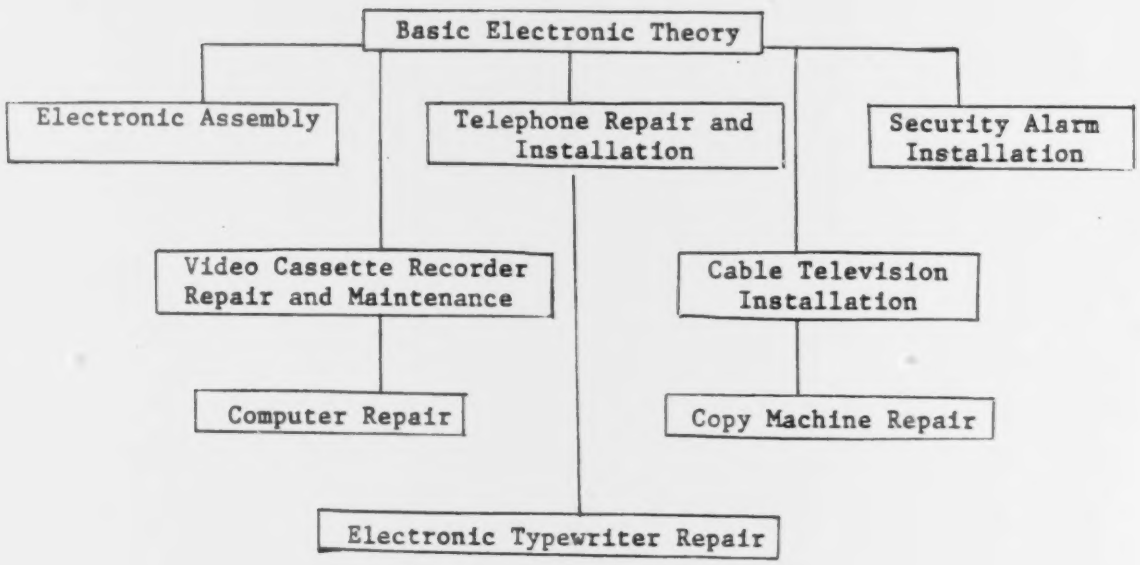
EMPLOYABILITY COMPETENCIES FOR ENTRY LEVEL OCCUPATIONS IN ELECTRONICS

PART ONE: BASIC THEORY



LOS ANGELES UNIFIED SCHOOL DISTRICT

Division of Adult and Occupational Education

Intsructional Services Unit

MANPOWER PROGRAMS

August 1, 1985

CE 042 842

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PREFACE

Electronic Occupations - A Competency-Based Program

Competencies for Electronic Occupations are presented in two main groups: (1) Basic Electronic Theory, and (2) Job Specific Skills.

Part One, Basic Electronic Theory, is a syllabus which represents the "core" competencies which students learn in all of the electronic occupational classes. Each page in the syllabus presents a competency statement which is defined by an "indicator", a performance objective, a "benchmark", a specific observable behavior or task, and finally, the "assessment", which describes the criteria for successful completion of each task. Attainment of basic electronic theory competencies are documented by written examinations.

The basic electronic theory competencies have been identified by a consensus opinion of instructional staff who mutually agreed to the elements of the core program. The appendix to Part One includes a series of vocabulary tests, designed to enhance learning of electronic concepts. The program can easily be adapted to a bilingual learning model because each unit is written to clearly present both what is desired in conceptual learning, and the related job performance objectives.

Job specific competencies are identified in Part Two and Part Three as follows:

Part Two: Job Safety
Electronic Assembly/Test Technician
Telephone Installation and Repair
Security Alarm Installation and Repair
Cable Television Installation
Video Cassette Recorder Repair

Part Three: Computer Repair
Copy Machine Repair
Electronic Typewriter Repair

Having taken into consideration employer input, instructors identified job specific competencies. Competency statements have been submitted by instructors for presentation under each job title. Documentation of job specific competencies will be accomplished by written examination or product produced.

Thus, the competency-based electronics program is a combination of basic theory with a job specific application. The competency syllabus provides each instructor with guidelines to develop their instructional program, so that, participants can be assured that completion of the program will result in the attainment of skills that will enable students to obtain training related employment. In addition, all of our competencies have been reviewed and validated by industry representatives.

It must be noted, that certain aspects of electronics will be taught in relation to the individual participant needs and potential for job placement. Advanced mathematics is one such topic. Math may not be required by all students to the same degree. Thus, although math is not over-looked, it is not shown herein as a basic competency. When pre-employment testing, or a particular job, requires mathematics, participants will receive instruction to assure the student is fully prepared.

Another area that is not shown in the basic competencies is the use of oscilloscopes and microscopes as related to electronic construction skills and electronic testing. When an instructor is preparing students

for a specific employer who requests workers with these abilities, students will receive training in the use of these items.

The integration of the material into course curriculums is dependent on the agency providing JTPA training services. Selection of competencies must be based on participant need and compatibility with the targeted occupation. The identification of Electronic Competencies does not attempt to provide input in regards to teaching methodology. The statements present a consensus opinion of optimum skill level for youth entering the work force in the field of entry level electronics.

ACKNOWLEDGEMENTS

Appreciation is extended to the Los Angeles Unified School District's Skills Center electronic occupations instructors, Bob Wilhelm, Anthony Fernandez, Robert Macias, Paul Rodriguez, Kook Lee, Bao Nguyen, Gracie Brown, Ganzia Washington, and Larry Gow for their participation in the identification of occupational competencies. The text has been developed and written by Claire Werner as part of the school district's contract with the City and County of Los Angeles and the State Department of Education.

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PART ONE:

BASIC ELECTRONIC THEORY

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MEANING OF ELECTRICITY

COMPETENCY AREA:	BASIC ELECTRONICS THEORY
COMPETENCY STATEMENT:	The trainee has a basic understanding of principles and concepts of electricity.
INDICATOR:	The trainee describes the meaning of electricity.
BENCHMARK:	The trainee defines the term electricity.
ASSESSMENT:	The trainee states the following: Electricity is the movement of electrons through a conductor.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes the meaning of electricity.

BENCHMARK: The trainee explains the meaning of matter and identifies the elements of matter.

ASSESSMENT: The trainee states the following:

1. Matter is anything that has weight and occupies space.

2. Matter is made up of atoms that are joined together to form specific compounds. The atom is the smallest part of matter. Each atom is made up of even smaller particles called electrons, protons, and neutrons.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes the meaning of electricity.

BENCHMARK: The trainee identifies which elements of the atom are positive, negative, or neutral.

ASSESSMENT: The trainee states the following:

1. Electrons have a negative charge.
2. Protons have a positive charge.
3. Neutrons have no charge.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes the meaning of electricity.

BENCHMARK: The trainee defines the terms free electrons, conductors, resistors, semiconductors, and insulators.

ASSESSMENT: The trainee provides the following minimum information:

1. Free Electrons - Electrons that can be moved or forced to move from one atom to another ... the movement of electrons is called electricity.

2. Conductors - Conductors are materials with free electrons. Conductors allow free electrons to flow from one atom to another. Silver and gold are both good conductors of electricity, but the conductors used most often are copper and aluminum.

3. Resistors - Limit current, produce voltage drop, and dissipate heat.

4. Semiconductors - Semiconductors are materials that are halfway between being good conductors and poor conductors.

5. Insulators - Insulators are the opposite of conductors. They do not give up electrons easily, they prevent the movement of electrons. Plastics, ceramics, wood, and glass are good insulators.

HOW ELECTRICITY WORKS

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee identifies the six methods used to make electricity.

ASSESSMENT: The trainee states the following methods:

1. Friction
2. Heat
3. Light
4. Pressure
5. Chemical action
6. Magnetism

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee describes how friction is used to make electricity.

ASSESSMENT: The trainee provides the following minimum information:

When certain materials are rubbed together, one picks up electrons from the other. The material that gains electrons has a negative charge. The material that loses electrons has a positive charge. These excess electrons can then jump to other atoms that have a positive charge. Nature is always seeking to balance the amount of electrons each material has so that the charges will be equal. When the excess electrons are standing still, "static electricity" is produced. "Static" means to stand still. The electricity produced by friction is called static electricity, this is because the electricity is not flowing.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee provides three examples of static electricity.

ASSESSMENT: The trainee states no less than three examples of static electricity. The following examples may be used:

1. Lighting
2. Walking across a carpet and reaching to a doorknob and getting a shock.
3. Xerography (photocopier)
4. Spray paint cars on an assembly line.
5. The need to ground gas trucks before the gas is pumped into tanks at gas stations.

The trainee describes how the use of static electricity is used in each of his/her three examples.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee describes how heat is used to produce electricity.

ASSESSMENT: The trainee provides the following minimum information:

Electricity can be produced by heat using a thermocouple. Thermo means "heat", and couple means "to join". A thermocouple consists of two different kinds of metals, such as copper and iron, that are joined together and then heated.

The point where the two unlike metals are joined is called the "junction". Two dissimilar metals are used. One metal has an excess of electrons and the other has a deficiency of electrons. When heated, the electrons move from the excess side through the circuit to the deficiency side.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee identifies the most common use of thermocouples.

ASSESSMENT: The trainee provides the following minimum information:

Thermocouples do not usually produce large quantities of electricity. They are most often connected to meters that measure temperature. These meters are used to measure temperatures in furnaces and ovens and to operate safety devices such as fire alarms.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee describes how light is used to produce electricity.

ASSESSMENT: The trainee provides the following minimum information:

Certain materials give off electrons when light strikes them. These light-sensitive materials are used to produce electron movement that generates electricity.

When the light strikes the sensitive material, copper oxide, electrons are given off. These electrons move from one surface to another. If the two surfaces are connected by a wire, the electrons will flow, generating electricity. The electricity produced depends on a number of things. One thing is the amount of light striking the sensitive material.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee names devices used to produce electricity.

ASSESSMENT: The trainee provides the following minimum information:

Devices that produce electricity from light are called "photo cells" or "solar cells." These cells can be used to charge batteries during the day for use during the night. If the cells are large enough, they can be used to provide electricity for an entire house.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee describes how pressure is used to produce electricity.

ASSESSMENT: The trainee provides the following minimum information:

Electricity can be produced by applying pressure to quartz and Rochelle salts. When pressure is applied to these crystals, electrons flow from one side of the crystal to the other.

Applying pressure to crystals to generate electricity is called the "piezoelectric" effect.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee identifies the most common use of the piezoelectric effect and provides one example of its use.

ASSESSMENT: The trainee provides the following minimum information:

1. This type of electricity generation is used in sound equipment, phonographs, and microphones.

2. Example: A piece of quartz crystal is placed in the pickup arm of a phonograph. A needle exerts pressure on the crystal. As the needle follows the grooves in a record, it puts a varying pressure on the crystal. This pressure generates a small amount of electricity. The weak current is then boosted by an amplifier that turns the energy into sound.

Other examples may be given.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee describes how chemical action is used to produce electricity.

ASSESSMENT: The trainee provides the following minimum information:

Electricity is generated when chemicals react with one another. These reactions produce free electrons. The device that produces electricity in this way is the battery.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee describes how a battery works to produce electricity.

ASSESSMENT: The trainee provides the following minimum information:

Each cell of a battery consists of two plates of different metals. These plates are called "electrodes". Most frequently, the electrodes are carbon and zinc. An electrolyte is also needed to make a cell. The electrolyte may be a liquid or a paste.

Electricity is generated by the chemical reaction between the metal plates and the electrolyte. The carbon electrode has a positive charge. The zinc electrode is negatively charged. If the two electrodes are connected by an electrolyte, the electrons will move from the zinc electrode to the carbon electrode by way of the external circuit. This movement of electrons produces electricity. If one connects a small light bulb to the two electrodes, the bulb will glow. This indicates that electrons are moving along the external path from electrode to electrode. This pathway is called a "circuit".

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee names and describes the two types of battery cells

ASSESSMENT: The trainee provides the following minimum information:

1. Primary cells generate electricity for a short period of time. They use chemical action. These cells are usually small. They are used for flashlights, radios, and other devices. These batteries cannot be recharged. The electrolyte used for these cells is a paste. They are also known as "dry cells".

2. Secondary cells are designed to be recharged. A direct current is forced through the cell. Charging takes place in the direction opposite to the direction it generates electricity. The most commonly used type of secondary cell is the lead-acid cell. It is used for car batteries. Secondary cells are also known as "wet cells". This is because the electrolyte is a liquid.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee identifies and names the parts of a dry battery cell.

ASSESSMENT: Given a "cut-away" picture of a dry battery cell, the trainee identifies and names the following parts:

1. Negative terminal binding post.
2. Positive terminal binding post.
3. Cover - plastic coated insulation board.
4. Expansion chambers.
5. Carbon electrode.
6. Depolarizing mix.
7. Chipboard jacket.
8. Zinc can - outside surface asphalt coated.
9. Past coated pulboard separator.
10. Seal support washer.
11. Inner seal asphalt.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee identifies and names the parts of a wet battery cell.

ASSESSMENT: Given a "cut-away" picture of a wet battery cell, the trainee identifies and names the following parts and gives a description of its function:

1. Built-in flame arrester vent for unremovable protection.
2. Liquid-gas separator area returns any liquid to reservoir.
3. Generous electrolyte reservoir prolongs battery life.
4. Centered plate strap and thru-the-partition cell connectors are highly vibration resistant.
5. High density paste for higher electrical output and more cycling life.
6. "Small window" wrought lead-calcium grid is strong, electrically efficient, and corrosion resistant.
7. Separator envelopes encapsulate plates to prevent shorting and vibration damage.
8. Hold-down ramp for secure mount.
9. Polypropylene case combines light weight and high impact strength.
10. Molded symbols permanently identify terminal polarity.
11. Cold forged terminals for added strength.
12. Built-in hydrometer for faster checking.
13. Heat sealed covers prevent electrolyte contamination and increase case strength.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee describes how electricity works.

BENCHMARK: The trainee describes how magnetism produces electricity.

ASSESSMENT: The trainee provides the following minimum information:

When a piece of copper wire is placed in a magnetic field and moved through it, electricity is generated. Cutting through the force field causes the electrons in the wire to move. The electrons are forced from one end of the copper wire to the other by the magnetic force field. The movement of electrons generates electricity.

If the copper wire is shaped into a coil and electricity is passed through it, the effect is reversed and a magnetic field is created. Magnetism produced this way is called "electomagnetism".

RESISTORS

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of the function and use of resistors.

BENCHMARK: The trainee defines the term resistor and names the two basic types of resistors.

ASSESSMENT: The trainee provides the following minimum information:

1. Resistors are conductors that do not easily give up their free electrons. They are used to control the amount of current in a circuit. All conductors provide some resistance to the movement of electrons. Resistors are useful because they provide a "measured" amount of resistance.

2. The two basic types of resistors are fixed and variable resistors.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of the function and use of resistors.

BENCHMARK: The trainee defines the terms "fixed resistor" and "variable resistor". He/she draws the symbols for each type of resistor.

ASSESSMENT: The trainee provides the following minimum information:

1. Fixed resistors have a single value of resistance that remains the same during use. These resistors may either be the carbon-composition type or the wire-wound type.

   Carbon-composition resistors consist of carbon granules that are compressed inside a plastic case. Each resistor has two leads inserted into the case to make contact with the carbon. The resistance of the carbon is fixed according to the heat and pressure that were applied to compress the carbon granules. Sizes range from less than 1 ohm to 12 million ohms. Fixed carbon-composition resistors are used in devices such as television sets, radios, tape recorders, and computers.

   The trainee draws the symbol .

2. Variable resistors provide differing amounts of resistance during use. Variable resistors come in both carbon and wire-wound types. In both types, a sliding arm makes contact with the stationary resistance element. The element is either carbon or resistance wire. Usually, the sliding arm is attached to a shaft. The shaft can be rotated in almost a complete circle. As it rotates, it increases the resistance from left to right.

   Two common variable resistors are rheostats and potentiometers. Rheostats are used in light dimmers to vary the intensity of lights. Potentiometers are used for volume controls on television sets and radios.

   The trainee draws the symbol .

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COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

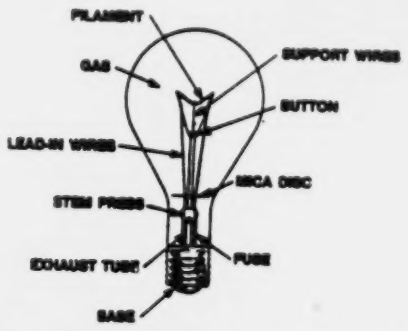
INDICATOR: The trainee demonstrates an understanding of the function and use of resistors.

BENCHMARK: The trainee identifies and names the parts of a light bulb. He/she explains how a light bulb works.

ASSESSMENT: Given a picture of a light bulb, the trainee identifies and names the following parts.

1. Filament
2. Button
3. Base
4. Lead-in wires
5. Gas
6. Mica disc
7. Exhaust tube
8. Support wires
9. Fuse
10. Stem press

The light bulb is a wire-wound resistor. The resistor is also called a filament. When the filament has current passed through it, it becomes hot enough to glow. This is called incandescence. The filament does not burn out for a long time because it is enclosed in a vacuum. The vacuum prevents oxygen from reaching the hot filament. The filament would burn out much more quickly in the presence of oxygen. In some larger sized bulbs, the filament is enclosed in inert argon gas. Inert means that the gas will not react with the hot filament. This prolongs the life of the filament.



Incandescent lamp and its parts.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of the function and use of resistors.

BENCHMARK: The trainee explains what "power rating" means.

ASSESSMENT: The trainee provides the following minimum information:

When electrical energy is consumed, heat is produced. In order for the circuit to work properly, this heat must be dissipated, or reduced. A resistor that has 12 watts of power forced through it must be large enough to dissipate 12 watts of heat. Resistors are rated according to the power they will dissipate. This rating is called the power rating. Wattage rating is another term for power rating.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

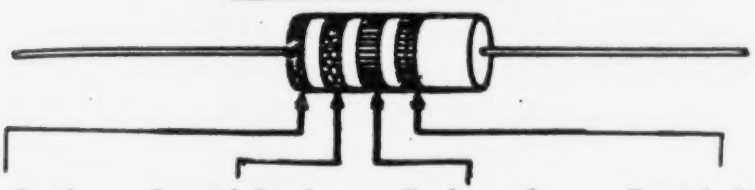
COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of the function and use of resistors.

BENCHMARK: The trainee determines resistant value for no less than five different carbon-composition resistors. He/she also indicates the level of tolerance.

ASSESSMENT: Using a color code chart for carbon-composition resistors, the trainee determines the level of resistance for each resistor in ohms and the amount of tolerance.

RESISTOR COLOR CODE



First Band 1st Digit | Second Band 2nd Digit | Number of Zeros | Fourth Band* Resistance Tolerance

Color	Digit	Color	Digit	Color	Dmmigit	Color	Tolerance
Black	0	Black	0	Black	0	Silver	±10%
Brown	1	Brown	1	Brown	1	Gold	±5%
Red	2	Red	2	Red	2	* No Band	±20%
Orange	3	Orange	3	Orange	3		
Yellow	4	Yellow	4	Yellow	4		
Green	5	Green	5	Green	5		
Blue	6	Blue	6	Blue	6		
Violet	7	Violet	7	Violet	7		
Gray	8	Gray	8	Gray	8		
White	9	White	9	White	9		
				Silver	x0.01		
				Gold	x0.1		

OHM'S LAW

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COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of Ohm's Law.

BENCHMARK: The trainee recites Ohm's Law and demonstrates the ability to apply the principle in no less than 30 problems related to current, voltage, and resistance. The trainee identifies and names the symbols in Ohm's Law.

ASSESSMENT: The trainee performs the following:

1. States Ohm's Law -

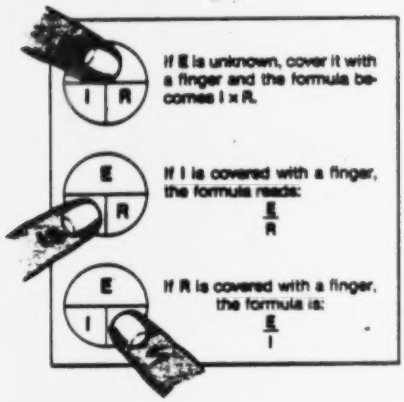
   "The current in any circuit is equal to the voltage divided by the resistance."

2. Identifies the following elements -

   $I = \frac{E}{R}$ or amperes = $\frac{\text{volts}}{\text{ohms}}$

3. Completes an exam correctly completing no less than 30 problems relating to the use of Ohm's Law.

   The trainee may use the following chart as an aid during the exam:


If E is unknown, cover it with a finger and the formula becomes I x R.
E
I R
If I is covered with a finger, the formula reads:
E
R
If R is covered with a finger, the formula is:
E
I

ELECTRICAL SYMBOLS

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

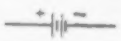
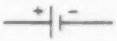
INDICATOR: The trainee demonstrates an understanding of electrical symbols commonly used on electrical drawings.

BENCHMARK: The trainee identifies and names electrical symbols.

ASSESSMENT: The trainee performs the following:

1. Given an exam on electrical symbols, writes the correct meaning next to each symbol with no less than 80% accuracy.
2. Given an electrical drawing, locates electrical symbols and identifies the meaning.

The symbols for the following words will be included on the exam:

1. Resistor -
2. Volts - V
3. Amperes - A
4. Resistance - R
5. Resistance in ohms - Ω
6. Battery - 
7. Switch closed -
8. Switch open -
9. Fuse -
10. Cell - 
11. Transformer -

SERIES CIRCUIT PRINCIPLES

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of series circuit principles.

BENCHMARK: The trainee names the three parts to a simple circuit and describes its function.

ASSESSMENT: The trainee provides the following minimum information:

1. Power supply - can be a single cell or a battery. It can also be 120 volts from a wall outlet. Electrical energy is created by a difference in potential (electromotive force). This difference causes electrons to move from one point to another along a conductor.

2. Consuming device - uses or consumes electrical energy. It may be a light bulb, toaster, or an electric motor. As the consuming device uses the electrical energy, it produces light, heat, or motion.

3. Controlling device - regulates the flow of electrons in the circuit. A switch is a controlling device. It can open or close a circuit.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of series circuit principles.

BENCHMARK: The trainee names and describes the three basic types of circuits. He/she explains the use of a fuse.

ASSESSMENT: The trainee provides the following minimum information:

1. Complete circuit -

   A circuit is a path along which electrons can flow. In a complete circuit, the electrons can flow from the negative electrode of a power source to the positive electrode without interruption. This type of circuit has at least a power supply and a consuming device.

2. Closed/open circuit -

   This type of circuit has a power supply, a consuming device, and a switch. The switch determines whether the circuit is open or closed. When the switch is closed, the circuit is complete. Electrons can then flow through the consuming device. This complete circuit is also called a closed circuit.

   An open circuit is an incomplete circuit. If the switch is not closed, the circuit will not be complete. The circuit could also be open because a connection is loose. if the consuming device is a light bulb, a burned-out filament could open the circuit.

3. Short circuit -

   A short circuit is an accidental connection. Instead of following the intended path, the electrons take a shortcut from the negative electrode to the positive electrode.

   If the short circuit is caused by a wire, the wire can get very hot because too much current is flowing through it. The danger is that a hot wire can cause a fire. Fuses are used to protect against such dangers. A fuse implodes when too much current flows through it. This opens the circuit and stops the flow of electrons.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of series circuit principles.

BENCHMARK: The trainee defines the term "series circuit".

ASSESSMENT: The trainee provides the following minimum information:

A "series circuit" is a circuit that is connected so that the electrons have only one path to follow. The power supply and the consuming devices are all placed end-to-end, so that the electrons can travel in a straight path from negative to positive.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of series circuit principles.

BENCHMARK: The trainee explains how cells work in a series.

ASSESSMENT: The trainee provides the following minimum information:

1. Cells are connected in series to produce more voltage.

2. When two cells are connected it produces a battery. A battery has more voltage than a single cell. To connect cells in series, one connects the negative electrode of one cell to the positive electrode of the next, and so forth. This provides only one path for the electrons to follow.

3. To determine how much voltage is provided by cells in series, add together the voltages of each cell.

4. More voltage is produced by cells in series. Current from the cells is only as much as one cell would provide.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of series circuit principles.

BENCHMARK: The trainee explains how resistance functions in a series and defines the terms "electrical load" and "voltage drop".

ASSESSMENT: The trainee provides the following minimum information:

Another term for a consuming device is "electrical load". A load is determined by the amount of resistance it causes to the circuit current flow. The smaller the resistance in ohms the larger the load. This is because a small resistance draws more current than a large resistance. Electrical load is measured in ohms.

In a series circuit, the total resistance of the circuit is found by adding the resistors, or loads. The total resistance of a circuit is the sum of the resistances of each load.

Resistors in a series reduces the amount of voltage delivered to the circuit output. This loss is called "voltage drop".

OCOMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of series circuit principles.

BENCHMARK: The trainee computes problems which determine voltage drop on a series circuit.

ASSESSMENT: Given a set of problems concerning voltage drop, the trainee completes problems with no less than 80% accuracy.

1. The trainee uses Ohm's Law to determine the current (I).

   $$I = \frac{\text{volts}}{\text{ohms}}$$

2. The trainee determines voltage drop by multiplying the current (I) times the resistance (R).

   Voltage drop (E) = I x R

PARALLEL AND SERIES-PARALLEL CIRCUITS

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

BENCHMARK: The trainee provides the three series circuit rules.

ASSESSMENT: The trainee provides the following information:

1. The applied voltage is equal to the sum of the individual voltage drops in the circuit.
2. The total current is the same as the current in any part of the circuit.
3. The total resistance of a series circuit is equal to the sum of the individual resistances.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

BENCHMARK: The trainee identifies the major advantages and disadvantages with the use of series circuits.

ASSESSMENT: The trainee provides the following minimum information:

The major disadvantage of a series circuit is that any disruption in the circuit will stop the current flow in the entire circuit. If one resistor opens, the entire circuit will not operate.

The major advantage of a series circuit is that by placing one switch in a series circuit, all the consuming devices may be turned on and off at the same time. This is why devices are inserted in a series for protection or control.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

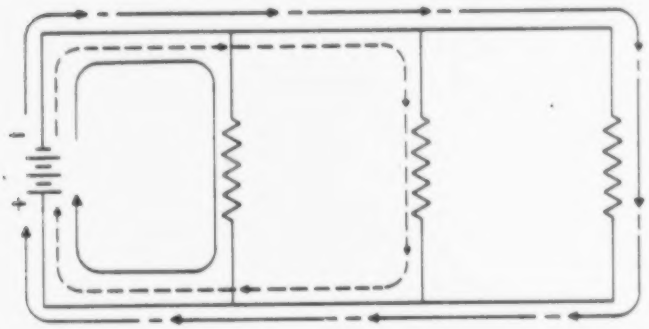
BENCHMARK: The trainee explains the meaning of "parallel circuit" and identifies a drawing of a parallel circuit.

ASSESSMENT: The trainee provides the following minimum information:

In a parallel circuit the electrons have more than one path to travel. The circuit has the load tapped off from the two power source leads and is connected positive to positive and negative to negative.

The trainee identifies a drawing of a parallel circuit on an electrical blueprint.

Parallel Circuit



COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

BENCHMARK: The trainee explains how cells are placed in parallel and how this effects current and voltage.

ASSESSMENT: The trainee provides the following minimum information:

When cells are connected in parallel, the positive pole of one is connected to the positive pole of another. The negative poles are connected negative to negative. This results in an increase in current. The total current of cells connected in parallel is the sum of the individual cells. When cells are connected in parallel, there is a current advantage.

The voltage of cells connected in parallel is that of one cell.

Example: If two 1.5 volt cells are connected in parallel, they produce only 1.5 volts. If each of these cells produces 0.25 amperes of current, then the total current available is 0.5 amperes.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

BENCHMARK: The trainee explains the effect of resistors on a parallel circuit. He/she correctly demonstrates the use of the formula to determine total resistance on a parallel circuit. He/she defines the term "reciprocal".

ASSESSMENT: The trainee provides the following minimum information:

The more resistances that are added to a parallel circuit the more paths the electrons have. As resistances are added in parallel, the total resistance decreases. This means the total current increases.

A reciprocal is "1" divided by a given number.

The trainee uses the following formula to compute no less than 10 problems of resistance on parallel circuits:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

BENCHMARK: The trainee demonstrates an understanding of the three basic rules which apply to a parallel circuit.

ASSESSMENT: Given problems to solve which apply to parallel circuits, the trainee correctly solves the problems demonstrating an understanding of the following rules:

Parallel Circuit Rules

1. Total current in a parallel circuit equals the sum of the currents through each resistor.

2. Voltage is the same across all resistors in a parallel circuit.

3. Total resistance in a parallel circuit is always less than the smallest resistance.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

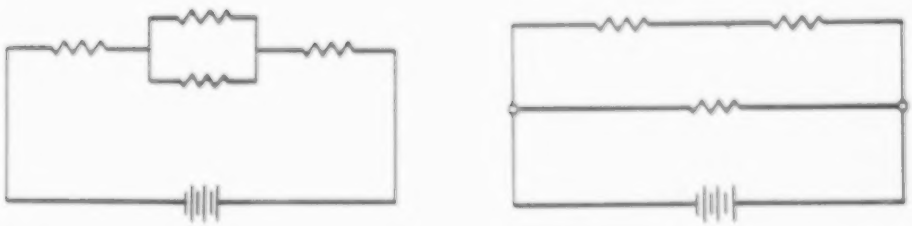
BENCHMARK: The trainee explains the meaning of "series-parallel circuit". He/she identifies series-parallel circuits on an electrical blueprint.

ASSESSMENT: The trainee provides the following minimum information:

This is a circuit having resistors connected both in a series and in parallel. In a series-parallel circuit, some of the resistors or consuming devices are connected in series. Other resistors are connected in parallel. Then the series and the parallel groups or branches are connected to form the series-parallel circuit.

Given an electrical blueprint, the trainee identifies series-parallel circuits.

Series-Parallel Circuits



COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

BENCHMARK: The trainee demonstrates an understanding of the basic rules for determining resistance in series-parallel circuits by correctly computing problems.

ASSESSMENT: Given a set of problems to determine the resistance in series-parallel circuits, the trainee completes the assignment with no less than 80% accuracy. The trainee successfully demonstrates his/her understanding of the following basic rules:

1. When necessary for clarity, redraw the series-parallel circuit.
2. Determine the total value of series resistors first. Add the values together.
3. Find the equivalent, or total, resistance of the resistors connected in parallel.
4. After the values for all resistors have been determined, add all the resistance values.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of parallel and series-parallel electrical circuits.

BENCHMARK: The trainee determines current and voltage in a series-parallel circuit.

ASSESSMENT: Given a set of problems, the trainee determines current and voltage in a series-parallel circuit, and completes the problems with no less than 80% accuracy.

The trainee successfully demonstrates his/her understanding of the following basic rules:

1. In a series circuit, current is the same through all resistors.
2. In a parallel circuit, divide voltage by resistance to determine the current.
3. When resistors are in series, add the voltages.
4. When resistors are in parallel, the voltage is the same across all resistors.

ELECTRICAL CURRENTS

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee provides the meaning of "direct current".

ASSESSMENT: The trainee provides the following minimum information:

Direct current is frequently called DC. The current only flows in one direction, from negative to positive. Direct current has polarity. The direction of the current flow is determined by the positive or negative polarity of the terminals.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee describes the meaning of "alternating current".

ASSESSMENT: The trainee provides the following minimum information:

Alternating current is current that periodically changes magnitude and direction. It is abbreviated as AC.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee provides the meaning of the terms "alternating current", "frequency", and "hertz".

ASSESSMENT: The trainee provides the following minimum information:

1. Alternating current, or AC, changes directions. If flows first in one direction and then in the other.

2. Frequency is used to indicate how often alternating current changes direction. Frequency is based on the number of times per second the current changes direction.

3. One hertz (Hz) is defined as the time required for a simple generator to rotate or make one revolution. One-half of a revolution is called an alternation. Two alternations make up one hertz. Hertz can occur in the thousands and millions. If the current changes direction 10,000 times in one second, its frequency is 5 kilohertz (kHz). If the current changes direction 10,000,000 times in a second, its frequency is 5 megahertz (MHz).

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee explains the terms "waveform", "sine wave", "peak value", "average value", and "rms value".

ASSESSMENT: The trainee provides the following minimum information:

1. Alternating current is constantly changing in magnitude and direction, this change is called waveform.

2. When alternating current is represented on a chart it is called sine wave.

3. Alternating current has three values as follows:

   a. Peak value is the point on the sine wave where the maximum height is obtained. This point represents the maximum current output.
   b. Average value is the value of all the instant values and thus represents the average current output.
   c. Rms is the abbreviation for root-means-square. The rms value is the effective value of voltage and current.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee describes the use of an inductor.

ASSESSMENT: The trainee provides the following minimum information:

Inductors oppose any change in current in a circuit. An inductor may be as simple as a coil of wire. When current in the coil increases and decreases, the magnetic field around the coil expands and contracts. This creates emf or voltage in the coil. The emf in the coil makes it difficult to increase or decrease the current. This opposition to change is called inductance. Inductors are also called chokes.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee names the factors which influence inductance.

ASSESSMENT: The trainee provides the following minimum information:

The inductance provided by an inductor depends on the size of the coil, the number of windings in the coil, and the core material.

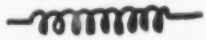
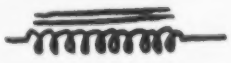
COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee identifies the symbols for inductance, air core inductor, iron core inductor, and the symbol for the measurement of inductance.

ASSESSMENT: The trainee draws the following symbols:

1. Air core inductor 
2. Iron core inductor 
3. Inductance letter L
4. Henrys letter H (unit of measurement)

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee describes the use of a transformer.

ASSESSMENT: The trainee provides the following minimum information:

Transformers are used to change voltage from one value to another. A transformer has two coils that are not connected. When a current is passed through one coil, it induces voltage in the other coil. Energy is transferred from one coil to the other. A transformer can either increase or decrease voltage.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical currents.

BENCHMARK: The trainee describes the use of a capacitor.

ASSESSMENT: The trainee provides the following minimum information:

Capacitors store an electrical charge for later use. A capacitor is made of two plates of conducting material separated by an insulator. Electrons are attracted to one plate as long as the power source is connected to the capacitor. The capacitor releases the stored energy when a pathway is connected from the negative to the positive plates. The charging and discharging of a capacitor is called capacitance. Capacitance is the property of a circuit that opposes a change in voltage.

COMPETENCY AREA:	BASIC ELECTRONICS THEORY
COMPETENCY STATEMENT:	The trainee has a basic understanding of principles and concepts of electricity.
INDICATOR:	The trainee demonstrates an understanding of electrical currents.
BENCHMARK:	The trainee distinguishes between inductors, transformers, and capacitors.
ASSESSMENT:	Given pictures or actual tools, the trainee identifies inductors, transformers and capacitors.

ELECTRICAL MEASUREMENT

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical measurement.

BENCHMARK: The trainee explains why electricity must be measured. He/she names the three ways electricity is measured.

ASSESSMENT: The trainee provides the following information:

1. It is almost impossible to study electricity without using measuring devices. This is because electricity cannot be seen, so the use of devices which detect the presence of electricity must be used. These devices are called "meters".

2. Meters will measure current, voltage, and resistance.

   Current, the flow of electrons in a circuit is measured in amperes.

   Voltage, or electrical pressure, is measured in volts.

   Resistance is measured in ohms.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical measurement.

BENCHMARK: The trainee names and identifies electrical meters.

ASSESSMENT: Given pictures or actual meters, the trainee identifies the following:

1. Alternating current voltmeter
2. Ammeter
3. Direct current voltmeter
4. Multimeter
5. Ohmmeter
6. Voltmeter
7. Watt-hour meter
8. Oscilloscope

COMPETENCY AREA:	BASIC ELECTRONICS THEORY
COMPETENCY STATEMENT:	The trainee has a basic understanding of principles and concepts of electricity.
INDICATOR:	The trainee demonstrates an understanding of electrical measurement.
BENCHMARK:	The trainee demonstrates the ability to measure electricity by correctly using various types of meters.
ASSESSMENT:	Given assignments to measure current, voltage, or electrical resistance, the trainee selects the correct meter and records the electrical measurement accurately.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of electrical measurement.

BENCHMARK: The trainee observes safety precautions when using meters.

ASSESSMENT: The trainee adheres to the following safety precautions:

1. Does not handle the probes of meters too close to the ends. He/she realizes that touching both metal strips will complete the circuit and will cause a shock.
2. Checks to make sure the meter movement is properly selected for use with alternating current or direct current.
3. Does not use an ohmmeter on a circuit with power applied.
4. Checks to make sure the meter is on the proper range.
5. Checks to make sure the meter is on the proper function.

SOLID-STATE DEVICES

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of how solid-state devices work.

BENCHMARK: The trainee defines the term "solid-state" and identifies the three primary solid-state devices.

ASSESSMENT: The trainee provides the following minimum information:

1. Solid-state means there is no open space between elements.

2. The three primary types of solid-state devices are:

   a. Semiconductor diodes
   b. Transistors
   c. Integrated circuits

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of how solid-state devices work.

BENCHMARK: The trainee demonstrates an understanding of how semiconductors are classified.

ASSESSMENT: The trainee provides the following minimum information:

Semiconductors are classified according to the type of material added to them. The process of adding material is called "doping". Doping which causes electrons to have a negative charge are classified as N-type. When doping results in a deficiency of electrons, the semiconductor is classified as P-type because the material has a positive charge.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of how solid-state devices work.

BENCHMARK: The trainee demonstrates basic knowledge of semi-conductor diodes by providing an explanation of what a semi-conductor diode is and what basic functions it performs.

ASSESSMENT: The trainee provides the following minimum information:

1. Semiconductor diodes are made of a combination of P-type and N-type materials which are joined together during manufacturing by a chemical process. The P-type material in the diode is called the "anode", the N-type material is called the "cathode".

2. When these two types of materials are joined, they allow current to pass in only one direction, which means they can be used to change alternating current to direct current.

3. The cathode lead is usually marked on the body of the diode by a dot or band. Cathodes are marked on all diodes. Cathodes have a negative polarity in semiconductors.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of how solid-state devices work.

BENCHMARK: The trainee names three types of diodes and explains the basic use of each type.

ASSESSMENT: The trainee provides the following information:

1. Zener diodes are used to regulate voltage in a circuit and to switch circuits. The zener diode is designed to take advantage of a condition called "avalanche breakdown".

2. Tunnel diodes performance is determined by the doping of the semiconductor material. Doping produces a diode that allows current to increase and decrease at regular intervals.

3. Silicon control rectifiers (SCRs) are used as a control device. The SCR has a circuit which controls the high resistance path. The varying of a voltage between the gate and the cathode section can control the current flow through the anode to the cathode section. An SCR conducts current only in the forward direction; that is, toward the positive terminal.

COMPETENCY AREA:	BASIC ELECTRONICS THEORY
COMPETENCY STATEMENT:	The trainee has a basic understanding of principles and concepts of electricity.
INDICATOR:	The trainee demonstrates an understanding of how solid-state devices work.
BENCHMARK:	The trainee identifies semiconductors on a schematic.
ASSESSMENT:	Given a schematic showing semiconductors, the trainee correctly identifies and names the semiconductors.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates an understanding of how solid-state devices work.

BENCHMARK: The trainee demonstrates a basic understanding of transistors by providing a description of a transistor, naming its parts, and describing its function.

ASSESSMENT: The trainee provides the following minimum information:

1. A transistor consists of two diodes connected back to back.

2. The three parts of a transistor are called emitter, the base, and the collector. These are abbreviated as E, B, and C on circuit diagrams.

3. The difference in the direction that the emitter arrow points on a circuit diagram represents the difference in polarity between NPN and PNP transistors.

4. The transistor is used most frequently with a common emitter. In this type of circuit, the current through the load flows between the emitter and the collector. The input signal is applied between the emitter and the base. Consequently, the emitter is "common" to, or part of, both the input and the output circuits.

5. By controlling the amount of resistance in the emitter-base circuit and the base-collector circuit, it is possible to obtain amplification - this is one of the transistor's most important functions.

ELECTRONIC VOCABULARY

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee demonstrates a basic understanding of the terms electrical power, and wattage.

ASSESSMENT: The trainee provides the following minimum information:

1. The energy required to push electrons through a resistance is also called electrical power. Electrical power is measured in watts. The abbreviation for watt is W. Watts are used to measure the work done by electricity. For example, 746 watts equal one horsepower. Wattage is determined by multiplying volts times amperes.

2. To figure out the wattage, or power, in a circuit the following formula is used:

   W = V X A or P = E X I

   P is the electrical symbol for power.
   E or V is the symbol for volts.
   A is the symbol for ampres.

3. In order to measure large amounts of electrical power, kilowatts are used. A kilo means one thousand. A kilowatt (kW) is 1,000 watts.

4. Electrical power is also measured in kilowatthours. The kilowatthour (kWh) is 1,000 watts used for one hour. Electrical bills are usually shown in kilowatthours.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee demonstrates a basic understanding of the term resistance.

ASSESSMENT: The trainee provides the following minimum information:

Whenever there is a movement in a circuit, there is friction. The movement of electrons along a conductor always meets with some resistance. Resistance is the opposition to electron movement.

Resistance is measured in ohms. A circuit has a resistance of one ohm when one volt of voltage applied to the circuit produces a current flow of one ampere in one second.

The Greek letter omega (Ω) is used to represent resistance.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee demonstrates a basic understanding of the term voltage.

ASSESSMENT: The trainee provides the following minimum information:

Electromotive force (emf) is needed to move electrons along the conductor. Emf is also called voltage (named after Alessandro Volta). The unit of measurement for voltage is the volt. The symbol for volt is V.

A volt is the amount of electrical pressure needed to force one ampere of electrons (6.28×10^{18} electrons) along a conductor in one second.

Volt can be divided into smaller units, such as a millivolt. A millivolt is one-thousandth of a volt.

The volt can also be used to measure pressures greater than one volt. Kilo means one thousand. A kilovolt (kV) is 1,000 volts. Mega means one million. A megavolt (MV) is 1,000,000 volts.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee demonstrates a basic understanding of the terms Milliampere and microampere.

ASSESSMENT:

1. The trainee provides the following minimum information:

   Current is also measured in smaller units than amperes. A milliampere is one-thousandth of an ampere. A small letter "m" is used to represent the prefix milli. The abbreviation for milliampere is mA. It may also be written as 0.001 A.

   An even smaller division of the ampere is the microampere. "Micro" means one-millionth. The Greek letter mu (μ) is used to indicate the prefix "micro", so the abbreviation for a microampere is __A. It may also be written as 0.000001 A. These smaller units are used in circuits for transistors.

2. The trainee completes a test where he/she matches the measurement with the correct amount with no less than 90% accuracy as follows:

   1 ampere = 1,000 milliamperes

   1 milliampere = 0.001 ampere

   1,000 milliamperes = 1 ampere

   1 microampere = 0.000001 ampere

   1,000 microamperes = 1 milliampere

   1,000,000 microamperes = 1 ampere

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee demonstrates a basic understanding of the terms current, ampere, and coulomb.

ASSESSMENT: The trainee provides the following minimum information:

Current is the flow of electrons along a conductor. In order to measure electron flow, or current flow, you must use the ampere. The ampere is a unit of measurement. Ampere is abbreviated as A. It is referred to as an amp.

An Ampere is the movement of a certain number of electrons past a given point in one second. The number of electrons is 6,280,000,000,000,000,000. This number is usually written in mathematical shorthand as 6.28×10^{18}.

Both current electricity and static electricity are measured by the number of electrons. If 6.28×10^{18} electrons are stationary on a surface, they make up one coulomb. If one coulomb of electrons passes a certain point in one second, it is an ampere.

Amperes are used to measure electrons in motion. Coulombs are used to measure electrons that are not moving.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee demonstrates a basic understanding of the terms circuit, emf, and voltage.

ASSESSMENT: The trainee provides the following minimum information:

A circuit is a pathway for electrons. In order for electrons to flow along a circuit, they must be pushed or forced. The force that causes the electrons to move is called the electromotive force or emf. The electrical pressure caused by emf is also called voltage.

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #1 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition:

1. Electricity
2. Matter
3. Atom
4. Free electrons
5. Conductor
6. Resistor
7. Semiconductor
8. Insulator
9. Static electricity
10. Thermocouple
11. Piezoelectric effect
12. Battery
13. Cell
14. Electrode
15. Electrolyte
16. Circuit
17. Primary cell
18. Secondary cell
19. Dry cell
20. Wet cell
21. Lodestone
22. Electromagnetism
23. Reluctance
24. Relay

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #2 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the definition.

1. Electromotive force (EMF)
2. Ampere
3. Coulomb
4. Milliampere
5. Microampere
6. Volt
7. Kilovolt
8. Megavolt
9. Resistance
10. Ohm
11. Electrical power
12. Watt
13. Fixed resistor
14. Nichrome
15. Variable resistor
15. Rheostate
16. Potentiometer
17. Filament
18. Incandenscence
19. Inert gas
20 Power rating
21. Wattage rating
22. Tolerance
23. Ohm's Law

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #3 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the definition as follows:

1. Symbol for resistance. Omega
2. Used to tell the value of a resistor. Color code
3. Plus or minus error allowed. Tolerance
4. 0.001 ampere. Milliampere
5. Power rating. Wattage rating
6. Unit of electrical pressure. Volt
7. Unit of resistance. Ohm
8. One thousand. Kilo
9. Opposition to electron movement. Resistance
10. 6.28×10^{18} electrons. Coulomb

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee competes vocabulary quiz #4 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the definition:

1. Power supply
2. Consuming device
3. Controlling device
4. Complete circuit
5. Closed circuit
6. Open circuit
7. Short circuit
8. Fuse
9. Series circuit
10. Electrical load
11. Voltage drop

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #5 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the definition as follows:

1. Switch. Controlling device
2. Path for electrons. Circuit
3. Uses electrical power. Consuming device
4. Has a path for electrons that is not through the load. Short circuit
5. A device that generates electricity. Cell
6. A circuit with a closed switch. Complete circuit
7. Two or more cells. Battery
8. A circuit with no path for electrons to flow. Open circuit
9. Another name for a resistance. Load

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #6 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the definition as follows:

1. Total resistance. R_T
2. The bottom half of a fraction that several other fractions will divide into evenly. Common denominator
3. Provides many paths for electrons to follow. Parallel circuit
4. The number 1 divided by another given number. Reciprocal
5. To turn upside down. Invert

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #7 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the appropriate definition.

1. Parallel circuit
2. Reciprocal
3. Direct current
4. Polarity
5. Alternating current
6. Frequency
7. Hertz (Hz)
8. Alternation
9. Alternator
10. Waveform
11. Sine wave
12. Peak value
13. Average value
14. rms value
15. Instant value
16. Rectifier

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #8 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the appropriate definition as follows:

1. Used to change voltages. Transformer
2. Unit of measurement for frequency. Hertz
3. How often a sine wave is generated. Frequency
4. Constantly changing in amplitude and direction. Alternating current
5. Point of maximum height on a sine wave. Peak value
6. Effective value. rms value
7. Sum of the instantaneous values divided by the number of values. Average value
8. AC generator. Alternator

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #9 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the appropriate definition.

1. Inductance
2. Inductor
3. Air-core inductor
4. Iron-core inductor
5. Choke
6. Inductive reactance
7. Ballasts
8. Step-down transformer
9. Step-up transformer
10. Turns ratio
11. Air-cire transformer
12. Capacitor
13. Dielectric
14. Capacitance
15. Farad
16. Microfarad
17. Picofarad
18. Electrolytic capacitor
19. Nonelectrolytic capacitor

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #10 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the appropriate definition.

1. Meter
2. Multimeter
3. Deflect
4. d'Arsonval meter movement
5. Ammeter
6. Linear
7. Full-scale deflection
8. Shunt
9. Voltmeter
10. Rectifier
11. Diode
12. Taut-band movement
13. Iron bane meter
14. Ohmmeter
15. Nonlinerar
16. Principle of successive approximations

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #11 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the appropriate definition.

1. Vacuum tube
2. Electronic circuits
3. Solid-state
4. Semiconductor
5. Doping
6. N-type material
7. P-type material
8. Anode
9. Cathcode
10. Avalanche breakdown
11. Transistor
12. PNP transistor
13. NPN transistor
14. Emitter
15. Base
16. Collector
17. Common emitter circuit

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #12 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the appropriate definition.

1. Diagonal cutting pliers
2. Long-nose pliers
3. Slip-joint pliers
4. Side-cutter pliers
5. Wire stripper/cutter
6. Phillips-head screwdriver
7. Allen wrench
8. Nut driver
9. Scratch awl
10. Chassis punch

COMPETENCY AREA: BASIC ELECTRONICS THEORY

COMPETENCY STATEMENT: The trainee has a basic understanding of principles and concepts of electricity.

INDICATOR: The trainee demonstrates a fundamental understanding of terminology commonly used in the field of electronics.

BENCHMARK: The trainee completes vocabulary quiz #13 with no less than 80% accuracy.

ASSESSMENT: The trainee matches the following terms with the correct definition by writing the correct word next to the appropriate definition.

1. Solder
2. Soldering iron
3. Flux
4. Rosin-core flux
5. Acid-core flux
6. Contact soldering
7. Dip soldering
8. Wave soldering
9. Tinning
10. Cold solder joint
11. Solder wick
12. Solder sucker
13. Desoldering iron

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APPENDIX

1. Study Guides

STUDY GUIDE FOR VOCABULARY QUIZ #1

ELECTRICITY.....Form of energy present when electrons move through a complete path.

MATTER.....Anything that has weight or mass and occupies space.

ATOM.....Smallest part of a chemical element that still retains all the properties of the element.

FREE ELECTRONS.....Those electrons loosely held by an atom. Electrons that are free to move from atom to atom with heat as the prime mover

CONDUCTOR.....Solid, liquid, or gas that permits flow of electrons.

RESISTOR.....Device that opposes current flow.

SEMICONDUCTOR.....Material that is able to conduct electricity under certain conditions and not conduct it under others.

INSULATOR.....Nonconducting material lacking a sufficient supply of free electrons to allow the movement of electrons without exceptional force or high voltage.

STATIC ELECTRICITY...Form of energy present when there are two charges of opposite polarity in close proximity. This type of electricity is generated by friction.

THERMOCOUPLE.....Device made of two different kinds of metals joined at one end. When the junction is heated, an emf is generated across the open ends.

PIEZOELECTRIC EFFECT.Process whereby emf is generated by pressure applied to a crystalline substance, usually Rochelle salts or quartz.

BATTERY.....Combination of two or more connected cells.

CELL.....Device that produces an emf by chemical action. Usually made from two electrodes and an electrolyte.

ELECTRODE.....One of the metal parts of a battery.

ELECTROLYTE.....Solution capable of conducting electric current; the liquid part of a battery.

CIRCUIT.....Pathway of conductors and devices designed for current flow.

PRIMARY CELL.....Cell that <u>cannot</u> be recharged.

SECONDARY CELL.....Cell that <u>can</u> be recharged.

DRY CELL.....Device that produces electricity through chemical action. Usually made of zinc and carbon with sal ammoniac as an electrolyte.

WET CELL.....A term used to indicate that the cell can be recharged. Is another term for a secondary cell.

LODESTONE.....Mineral with magnetic properties; a natural magnet.

ELECTROMAGNETISM....Magnetism produced by current flowing through a coil of wire or other conductor.

RELUCTANCE.....The term used for resistance in magnetism.

RELAY.....Electromagnetic device used for remote switching.

STUDY GUIDE FOR VOCABULARY QUIZ # 2

ELECTROMOTIVE FORCE (EMF) Another term used to mean voltage.

AMPERE.....Basic unit of electric current. One is equal to 6.28×10^{18} electrons flowing past a given point in one second.

COULOMB.....Unit of measure for electrons at rest on a surface area.

MILLIAMPERE.....One-thousandth of an ampere; abbreviated mA.

MICROAMPERE.....One-millionth of an ampere; abbreviated μA.

VOLT.....Unit of measurement of electromotive force; V.

KILOVOLT.....One thousand volts: kV.

MEGAVOLT.....One million volts; MV.

RESISTANCE.....Opposition to the movement of electrons; measured in ohms.

OHM.....Unit of measure for electrical resistance; abbreviated with Greek letter omega (Ω).

ELECTRICAL POWER....The energy required to push electrons through a resistance.

WATT.....Unit of electrical power; abbreviated W.

FIXED RESISTOR.....A resistor that has a fixed amount of resistance.

NICHROME.....A special alloy that is used as a resistance wire in resistors and heating elements.

VARIABLE RESISTOR...A resistor so arranged so that a sliding middle contact can be moved to change the resistance desired.

RHEOSTAT.....Variable resistor; usually has only tow points connected into circuit. Used to control voltage by increasing and decreasing resistance.

POTENTIOMETER.....Variable resistor that has three contact points.

FILAMENT.....Small coil of resistance wire in light bulbs and vacuum tubes that heats up to glow either red or white

INCANDESCENCE.....The white hot glow produced by a filament that is passing current.

INERT GAS.....A gas that will not react with other compounds.

POWER RATING.....The wattage rating of a device.

WATTAGE RATING.....The unit of measure used to indicate how much heat electrical power a device can handle.

TOLERANCE.....The plus or minus allowances of a resistor or capacitor or any other device.

OHM'S LAW.....Basic electrical law stating the relationships of voltage, current, and resistance; current in a circuit is equal to the voltage divided by the resistance.

STUDY GUIDE FOR VOCABULARY QUIZ #4

POWER SUPPLY.....Anything that will deliver electrical power.

CONSUMING DEVICE.....Any electrical device that consumes power.

CONTROLLING DEVICE...Usually refers to a switch.

COMPLETE CIRCUIT.....A circuit that has a complete path for electron flow from the battery or power source and back.

CLOSED CIRCUIT.....Usually refers to a cable-connected television and reciever. Any closed loop from a power source and back.

OPEN CIRCUIT.....A circuit that does not have a complete path for electrons to flow from and back to the power source.

SHORT CIRCUIT.....A circuit that has less resistance than intended.

FUSE.....Safety device designed to open if an excess flows through a circuit.

SERIES CIRCUIT.....A circuit made up of two or more resistors or consuming devices connected one after the other or negative to positive.

ELECTRICAL LOAD.....Anything that consumes electrical energy.

VOLTAGE DROP.....The same meaning as the terms voltage difference, emf, and electrical pressure. The amount of pressure or voltage dropped across a resistor or consuming device.

STUDY GUIDE FOR VOCABULARY QUIZ #7

PARALLEL CIRCUIT.....A circuit that has the load tapped off from the two power source leads and is connected positive to positive and negative to negative.

RECIPROCAL.....Any number with a one over it.

DIRECT CURRENT.....Current that flows in one direction only; abbreviated DC.

POLARITY.....Term for opposite positions and properties of electricity, such as negative or positive terminals of a battery or capacitor.

ALTERNATING CURRENT..Current that periodically changes magnitude and direction; abbreviated AC.

FREQUENCY.....Term describing the number of times an alternating current (AC) completes its cycle in one second.

HERTZ (Hz).....Unit of measurement of frequency; abbreviated Hz.

ALTERNATION.....The revolution of one-half of a sine wave.

ALTERNATOR.....AC generator.

WAVEFORM.....Any configuration that varies at a given rate or frequency.

SINE WAVE.....The signature of alternating current.

PEAK VALUE.....The point at which the sine wave or any wave peaks or reaches its maximum point.

AVERAGE VALUE.....The average of any number of values.

rms VALUE .....The root-means-square value. Equal to 0.707 of the peak value of a sine wave. Effective value.

INSTANT VALUE.....Any point along a sine wave that can be determined for use in finding the average or rms values.

RECTIFIER.....Device that changes AC to DC; allows current flow in only one direction.

STUDY GUIDE FOR VOCABULARY QUIZ #9

INDUCTANCE.....Property of a coil that opposes any change in circuit current; symbol is L. Measured in henrys.

INDUCTOR.....Device made by turns of insulated wire wound around a core.

AIR-CORE INDUCTOR.....An inductor (coil or choke) that has no core. It is used in circuits where radio frequencies are present.

IRON-CORE INDUCTOR.....An inductor or choke that is designed to operate on audio frequencies.

CHOKE.....Another name for a coil or inductor.

INDUCTIVE REACTANCE.....Opposition presented to alternating current by an inductor; symbol is X_L.

BALLASTS.....Choke or inductor used in a gaseous discharge (including flourescent) lamp circuit.

STEP-DOWN TRANSFORMER.....A transformer that steps down the voltage from the primary to the secondary. Usually means a step up in the current available.

STEP-UP TRANSFORMER.....A transformer that steps up the voltage from the primary to the secondary. Usually means a step down in the current available.

TURNS RATIO.....The input to the output number of turns of a transformer. The ratio of the primary turns of a transformer to the secondary turns.

AIR-CORE TRANSFORMER.....A transformer with no core. It is used in circuits where radio frequencies are present.

CAPACITOR.....Device used to store an electric charge. Consists of two plates and a dielectric.

DIELECTRIC.....Insulating material used in a capacitor or other electrical device.

CAPACITANCE.....Property of a capacitor that allows it to store an electric charge measured in farads (F).

FARAD.....Unit of measurement; abbreviated F. Represents the amount of capacitance needed to produce 1 ampere of current flow when a circuit has a change of 1 volt per second.

ELECTROLYTIC CAPACITOR.....A capacitor that has polarity.

NONELECTROLYTIC CAPACITOR..A capacitor that does not have polarity.

STUDY GUIDE FOR VOCABULARY QUIZ #10

METER.....Instrument used to measure.

MULTIMETER.....A meter with several different scales used to measure several types of electrical units.

DEFLECT.....To move aside.

d'ARSONVAL METER MOVEMENT...Portion of meter consisting of fixed permanent magnet and moving electromagnetic coil.

AMMETER.....Device used to measure current in a circuit. Both AC and DC ammeters are available.

LINEAR.....Evenly spaced.

FULL-SCALE DEFLECTION..Refers to a meter's full-scale movement.

SHUNT.....Means parallel. May be used to bypass current around a meter movement or any other device.

VOLTMETER.....Instrument used to measure voltage.

RECTIFIER.....Device that changes AC to DC; allows current flow in only one direction.

DIODE.....Device used to change AC to DC. Can either be vacuum tube or semiconductor.

TAUT-BAND MOVEMENT.....A method used to suspend the moving coil of a DC meter movement. The band acts as the mount and the spring for return action.

IRON VANE METER.....A type of meter used to measure alternating current.

OHMMETER.....Device used to measure electrical resistance in ohms.

NONLINEAR.....A designation used to indicate that the spacing is not necessarily even.

STUDY GUIDE FOR VOCABULARY QUIZ #11

VACUUM TUBE.....A device designed to control the flow of current through an electronics circuit. It consists of two, three, or more elements spaced apart and mounted in a vacuum type container.

ELECTRONIC CIRCUITS....Circuits that use a semiconductor device or a vacuum tube.

SOLID-STATE.....Used to designate semiconductor material devices. The operating device is made of solid materials as opposed to the old vacuum tubes that had elements that did not touch.

DOPING.....The act of placing impurities in silicon or germanium to produce semiconductor devices.

N-TYPE MATERIAL.....Semiconductor material that has an excess of electrons.

P-TYPE MATERIAL.....A semiconductor material that has a deficiency of electrons or excess holes.

ANODE.....Positive terminal of a device such as a vacuum tube, battery, or semiconductor diode.

CATHCODE.....Part of a vacuum tube that emits electrons. May also be one terminal of a semiconductor diode, generally the point at which electrons enter the diode.

AVALANCHE BREAKDOWN....The term used to describe the point where the zener diode starts to function as designed.

TRANSISTOR.....Semiconductor device used to amplify signals or for switching; derived from "transfer resistor".

PNP TRANSISTOR.....A transistor that has a positive, negative, positive arrangement of the semiconductor material.

NPN TRANSISTOR.....A transistor that has its materials aligned in a negative, positive, negative sequence.

EMITTER.....One of the elements of a transistor.

BASE.....The middle connection on a transistor. It is the part sandwiched between the emitter and collector.

COLLECTOR.....One of the three elements of a transistor.

COMMON EMITTER CIRCUIT.A circuit using a transistor where the input is between the base and emitter and the output is taken from the emitter to the collector.

STUDY GUIDE FOR VOCABULARY QUIZ #12

DIAGONAL CUTTING PLIERS....A tool that has cutting edges sharp enough to cut wires.

LONG-NOSE PLIERS.....A pair of pliers with long ends that can be used in tight situations.

SLIP-JOINT PLIERS.....Pliers that can be made to handle wider materials by slipping the hinge point slightly to allow for a wider opening.

SIDE-CUTTER PLIERS.....Pliers, usually having heavy duty handles, with the ability to cut through heavy gage wire.

WIRE STRIPPER/CUTTER.....Device or tool used to remove insulation from a piece of wire.

PHILLIPS-HEAD SCREWDRIVER..A screwdriver that has a cross-shaped end to fit specially made screw heads.

ALLEN WRENCH.....Allen wrenches are shafts of metal designed to slip into special screws.

NUT DRIVER.....A device that looks like a screwdriver with a socket wrench on one end.

SCRATCH AWL.....An ice-pick type device used to scratch or score metal or wood.

CHASSIS PUNCH.....A tool used to cut metal shapes out of radio and electronic project chassis.

STUDY GUIDE FOR VOCABULARY QUIZ #13

SOLDER — A combination of metals, usually tin and lead, used to join two components.

SOLDERING IRON — A tool used to melt solder to connect two pieces of metal.

FLUX — A material used to prevent oxidation when a solder joint is heated sufficiently to melt solder.

ROSIN-CORE FLUX — Flux that is made of a rosin and inserted as a core in solder used for electronic work.

ACID-CORE FLUX — Flux used in the solder is acid in nature.

CONTACT SOLDERING — The type of soldering done with a soldering iron and solder wire applied by hand.

DIP SOLDERING — In this type of soldering, the entire connection to be soldered is dipped into a pot of hot solder.

WAVE SOLDERING — The type of soldering used by industry to solder printed circuit boards. A wave of molten solder is directed against a printed circuit board with all the components temporarily mounted in the board. Flux is brushed over the bottom of the board, and it is moved across and slightly through the wave of molten solder to affix the components permanently to the printed circuit board.

TINNING — The act of putting a coating of solder on the tip of a soldering iron or a coating on copper wire.

COLD SOLDER JOINT — A solder joint that results when the metals to be soldered are not brought up to heat sufficient to melt the solder. Such a joint usually causes trouble later.

SOLDER WICK — A braided wire that, when heated, will absorb excess molten solder.

SOLDER SUCKER — A device used to suck hot solder from a joint. It usually consists of a squeeze-bulb that has a nylon tip mounted on the end to take the heat.

DESOLDERING IRON — A device that is coupled with a soldering iron to remove unwanted solder.

VOCABULARY QUIZES

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #1

DIRECTIONS: Write each term next to the correct definition.

Electricity	Static Electricity	Primary Cell
Matter	Thermocouple	Secondary Cell
Atom	Piezoelectric Effect	Dry Cell
Free Electrons	Battery	Wet Cell
Conductor	Cell	Lodestone
Resistor	Electrode	Electromagnetism
Semiconductor	Electrolyte	Reluctance
Insulator	Circuit	Relay

_____ Smallest part of a chemical element that still retains all the properties of the element.

_____ Anything that has weight or mass and occupies space.

_____ Material that is able to conduct electricity under certain conditions and not conduct it under others.

_____ Device made of two different kinds of metals joined at one end. When the junction is heated, an emf is generated across the open ends.

_____ Combination of two or more connected cells.

_____ Device that produces an emf by chemical action. Usually made from two electrodes and an electrolyte.

_____ Form of energy present when electrons move through a complete path.

_____ Cell that <u>cannot</u> be recharged.

_____ Cell that <u>can</u> be recharged.

_____ Electromagnetic device used for remote switching.

_____ Those electrons loosely held by an atom. Electrons that are free to move from atom to atom with heat as the prime mover.

_____ Nonconducting material lacking a sufficient supply of free electrons to allow the movement of electrons without exceptional force or high voltage.

_____ Process whereby emf is generated by pressure applied to a crystalline substance, usually Rochelle salts or quartz.

_____ One of the metal parts of a battery.

(CONTINUES ON OTHER SIDE)

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #2

DIRECTIONS: Write each term next to the correct definition.

-Electromotive Force (emf)	-Volt	-Electrical Power	-Rheostat
-Ampere	-Kilovolt	-Watt	-Potentiometer
-Coulomb	-Megavolt	-Fixed Resistor	-Filament
-Milliampere	-Resistance	-Nichrome	-Incandescence
-Microampere	-Ohm	-Variable Resistor	-Inert Gas
-Power Rating	-Tolerance	-Ohm's Law	-Wattage Rating

_____ One million volts; MV.

_____ Unit of measurement of electromotive force; V.

_____ Unit of measure for electrical resistance; abbreviated with Greek letter omega Ω.

_____ Variable resistor that has three contact points.

_____ Variable resistor; usually has only two points connected into circuit. Used to control voltage by increasing and decreasing resistance.

_____ A term used to mean voltage.

_____ Basic unit of electrical current. One is equal to 6.28×10^{18} electrons flowing past a given point in one second.

_____ One thousand volts; kV.

_____ Unit of measure for electrons at rest on a surface area.

_____ One-millionth of an ampere; abbreviated μA.

_____ One-thousandth of an ampere; abbreviated mA.

_____ Opposition to the movement of electrons; measured in ohms.

_____ Small coil of resistance wire in light bulbs and vacuum tubes that heats up to glow either red or white hot.

_____ Basic electrical law stating the relationships of voltage, current, and resistance; current in a circuit is equal to the voltage divided by the resistance.

_____ Unit of electrical power abbreviated W.

_____ A special alloy that is used as a resistance wire in resistors and heating elements.

(CONTINUES ON OTHER SIDE)

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #3

DIRECTIONS: Write each term next to the appropriate meaning.

Omega	Coulomb
Color code	Volt
Tolerance	Ohm
Milliampere	Kilo
Wattage rating	Resistance

_____ Symbol for resistance.

_____ Power rating.

_____ Used to tell the size of a resistor.

_____ Plus or minus value.

_____ Unit of electrical pressure.

_____ Opposition to electron movement.

_____ One thousand.

_____ 6.28×10^{18} electrons.

_____ Unit of resistance.

_____ 0.001 ampere.

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #4

DIRECTIONS: Write each term next to the correct definition.

Power Supply	Fuse
Consuming Device	Series Circuit
Controlling Device	Electrical Load
Complete Circuit	Voltage Drop
Closed Circuit	Open Circuit
Short Circuit	

_____ Anything that consumes electrical energy.

_____ Anything that will deliver electrical power.

_____ Any closed loop from a power source and back.

_____ A circuit that has less resistance than intended.

_____ Any electrical device that consumes power.

_____ A circuit that has a complete path for electron flow from the battery or power source and back.

_____ A circuit that does not have a complete path for electrons to flow from and back to the power source.

_____ A circuit made up of two or more resistors or consuming devices connected one after the other or negative to positive.

_____ Safety device designed to open if an excess flows through the circuit.

_____ The same meaning as the terms voltage difference, emf, and electrical pressure. The amount of pressure or voltage dropped across a resistor or consuming device.

_____ Usually refers to a switch.

Electricity and Electronics

Vocabulary Quiz # 5

DIRECTIONS: Write each word next to the appropriate meaning.

Circuit	Short circuit
Load	Complete circuit
Consuming device	Cell
Battery	Controlling device
Open circuit	

_____ Switch

_____ Path for electrons.

_____ Uses electrical power.

_____ Has a path for electrons that is not through a load.

_____ A device that generates electricity.

_____ A circuit with a closed switch.

_____ Two or more cells.

_____ A circuit with no path for electrons to flow.

_____ Another name for a resistance.

Electricity and Electronics

Vocabulary Quiz #6

DIRECTIONS: Write each term next to the appropriate meaning.

Reciprocal	Invert
Parallel circuit	Common denominator
R_T	

_____ Total resistance.

_____ The bottom half of a fraction that several other fractions will divide into evenly.

_____ Provides many paths for electrons to follow.

_____ The number 1 divided by another given number.

_____ To turn upside down.

Electricity and Electronics

Vocabulary Quiz #7

DIRECTIONS: Write each term next to the correct definition.

Parallel circuit	Alternating current	Alternator	Average value
Reciprocal	Frequency	Waveform	rms Value
Direct current	Hertz (Hz)	Sine wave	Instant value
Polarity	Alternation	Peak value	Rectifier

_____ Term for opposite positions and properties of electricity, such as negative or positive terminals of a battery or capacitor.

_____ A circuit that has the load tapped off from the two power source leads and is connected positive to positive and negative to negative.

_____ The point at which the sine wave or any wave peaks or reaches its maximum point.

_____ Device that changes AC to DC; allows current flow in only one direction.

_____ Term describing the number of times an alternating current (AC) completes its cycle in one second.

_____ Any configuration that varies at a given rate or frequency.

_____ Any number with a one over it.

_____ Unit of measurement of frequency; abbreviated Hz.

_____ Current that flows in one direction only; abbreviated DC.

_____ AC generator.

_____ The average of any number of value.

_____ Current that periodically changes magnitude and direction; abbreviated AC.

_____ The signature of alternating current.

_____ Any point along a sine wave that can be determined for use in finding the average or rms value.

_____ The root-means-square value. Equal to 0.707 of the peak value of a sine wave. Effective value.

_____ The revolution of one-half of a sine wave.

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #8

DIRECTIONS: Write each term next to the correct meaning.

Alternating current	Alternator
Hertz	Transformer
Frequency	Peak value
rms Value	Average value

_____ Used to change voltages.

_____ Unit of measurement for frequency.

_____ How often a sine wave is generated.

_____ Constantly changing in amplitude and direction.

_____ Point of maximum height on a sine wave.

_____ Effective value.

_____ Sum of the instantaneous values divided by the number of values.

_____ AC generator.

Electricity and Electronics

Vocabulary Quiz #9

DIRECTIONS: Write each term next to the correct definition.

Inductance	Choke	Step-up transformer
Inductor	Inductive reactance	Turns ratio
Air-core inductor	Ballasts	Air-core transformer
Iron-core inductor	Step-down transformer	Capacitor
Dielectric	Capacitance	Farad
Electrolytic capacitor		Nonelectrolytic capacitor

_____ Property of a coil that opposes any change in circuit current; symbol is L. Measured in henrys.

_____ Choke or inductor used in a gaseous discharge, including flourescent, lamp circuit.

_____ A transformer that steps up the voltage from the primary to the secondary. Usually means a step down in the current available.

_____ The input to the output number of turns of a transformer. The ratio of the primary turns of a transformer to the secondary turns.

_____ A capacitor that has polarity.

_____ Device made by turns of insulated wire wound around a core.

_____ Another name for a coil or inductor.

_____ A transformer with no core. It is used in circuits where radio frequencies are present.

_____ Property of a capacitor that allows it to store an electric charge measured in farads (F).

_____ Unit of measurement; abbreviated F. Represents the the amount of capacitance needed to produce 1 ampere of current flow when a circuit has change of 1 volt per second.

_____ An inductor or choke that is designed to operate on audio frequencies.

_____ Opposition presented to alternating current by an inductor; symbol is X_L.

_____ Device used to store an electric charge. Consists of two plates and a dielectric.

(CONTINUED ON OTHER SIDE)

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #10

DIRECTIONS: Write each term next to the correct definition.

Meter	Linear	Diode
Multimeter	Full-scale deflection	Taut-band movement
Deflect	Shunt	Iron vane meter
d'Arsonval meter movement	Voltmeter	Ohmmeter
Ammeter	Rectifier	Nonlinear

_____ To move aside.

_____ Evenly spaced.

_____ Means parallel. May be used to bypass current around a meter movement or any other device.

_____ Device used to measure electrical resistance in ohms.

_____ Instrument used to measure.

_____ Device used to measure current in a circuit.

_____ Portion of meter consisting of fixed permanent magnet and moving electromagnetic coil.

_____ A method used to suspend the moving coil of a DC meter movement.

_____ A designation used to indicate that the spacing is not necessarily even.

_____ Instrument used to measure voltage.

_____ Device that changes AC to DC; allows current flow in only one direction.

_____ Device used to change AC to DC. Can either be vacuum tube or semiconductor.

_____ A meter with several different scales used to measure several types of electrical units.

_____ A type of meter used to measure alternating current.

_____ Refers to a meter's full-scale movement.

Electricity and Electronics

Vocabulary Quiz #11

DIRECTIONS: Write each term next to the correct definition.

Vacuum tube	P-type material	PNP Transistor
Electronic circuits	Anode	NPN Transistor
Solid-state	Cathcode	Emitter
Doping	Avalanche breakdown	Base
N-type material	Transistor	Collector
	Common emitter circuit	

_____ Used to designate semiconductor material devices. The operating device is made of solid materials as opposed to the old vacuum tubes that had elements that did not touch.

_____ The term used to describe the point where the zener diode starts to function as designed.

_____ The middle connection on a transistor. It is the part sandwiched between the emitter and collector.

_____ One of the three elements of a transistor.

_____ A device designed to control the flow of current through an electronics circuit. It consists of two, three, or more elements spaced apart and mounted in a vacuum type container.

_____ The act of placing impurities in silicon or germanium to produce semiconductor devices.

_____ Part of a vacuum tube that emits electrons. May also be one terminal of a semiconductor diode, generally the point at which electrons enter the diode.

_____ Circuits that use a semiconductor device or a vacuum tube.

_____ A semiconductor material that has a deficiency of electrons or excess holes.

_____ Semiconductor material that has an excess of electrons.

_____ A transistor that has a positive, negative, positive arrangement of the semiconductor material.

_____ A transistor that has its material aligned in a negative, positive, negative sequence.

CONTINUED ON OTHER SIDE

Electricity and Electronics

Vocabulary Quiz #12

DIRECTIONS: Write each term next to the correct definition.

Diagonal cutting pliers	Side-cutter pliers	Allen wrench
Long-nose pliers	Wire stripper/cutter	Nut driver
Slip-joint pliers	Phillips-head screwdriver	Scratch awl
	Chassis punch	

_____ Tool used to remove insulation from a piece of wire.

_____ A device that looks like a screwdriver with a socket wrench on one end.

_____ A tool that has cutting edges sharp enough to cut wires.

_____ Pliers that can be made to handle wider materials by slipping the hinge point slightly to allow for a wider opening.

_____ A tool used to cut metal shapes out of radio and electronic project chassis.

_____ A screwdriver that has a cross-shaped end to fit specially made screw heads.

_____ Wrenches are shafts of metal designed to slip into special screws.

_____ A pair of pliers with long ends that can be used in tight situations.

_____ An ice-pick type device used to scratch or score metal or wood.

_____ Pliers, usually having heavy duty handles, with the ability to cut through heavy gage wire.

Electricity and Electronics

Vocabulary Quiz #13

DIRECTIONS: Write each term next to the correct definition.

Solder	Acid-core flux	Tinning
Soldering Iron	Contact soldering	Cold solder joint
Flux	Dip soldering	Solder wick
Rosin-core flux	Wave soldering	Solder sucker
	Desoldering Iron	

_____ A device that is coupled with a soldering iron to remove unwanted solder.

_____ The type of soldering used by industry.

_____ A combination of metals, usually tin and lead, used to join two components.

_____ A material used to prevent oxidation when a solder joint is heated sufficiently to melt solder.

_____ Flux used in the solder is acid in nature.

_____ In this type of soldering, the entire connection to be soldered is dipped into a pot of hot solder.

_____ A braided wire that, when heated, will absorb excess molten solder.

_____ The act of putting a coating of solder on the tip of a soldering iron or a coating on copper wire.

_____ A tool used to melt solder to connect two pieces of metal.

_____ A solder joint that results when the metals to be soldered are not brought up to heat sufficient to melt the solder. Such a joint usually causes trouble later.

_____ Flux that is made of a rosin and inserted as a core in solder used for electronic work.

_____ A device used to suck hot solder from a joint.

_____ The type of soldering done with a soldering iron and solder wire applied by hand.

VOCABULARY QUIZES

ANSWER KEYS

ANSWER KEY

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #1

DIRECTIONS: Write each term next to the correct definition.

Electricity	Static Electricity	Primary Cell
Matter	Thermocouple	Secondary Cell
Atom	Piezoelectric Effect	Dry Cell
Free Electrons	Battery	Wet Cell
Conductor	Cell	Lodestone
Resistor	Electrode	Electromagnetism
Semiconductor	Electrolyte	Reluctance
Insulator	Circuit	Relay

ATOM	Smallest part of a chemical element that still retains all the properties of the element.
MATTER	Anything that has weight or mass and occupies space.
SEMICONDUCTOR	Material that is able to conduct electricity under certain conditions and not conduct it under others.
THERMOCOUPLE	Device made of two different kinds of metals joined at one end. When the junction is heated, an emf is generated across the open ends.
BATTERY	Combination of two or more connected cells.
CELL	Device that produces an emf by chemical action. Usually made from two electrodes and an electrolyte.
ELECTRICITY	Form of energy present when electrons move through a complete path.
PRIMARY CELL	Cell that <u>cannot</u> be recharged.
SECONDARY CELL	Cell that <u>can</u> be recharged.
RELAY	Electromagnetic device used for remote switching.
FREE ELECTRONS	Those electrons loosely held by an atom. Electrons that are free to move from atom to atom with heat as the prime mover.
INSULATOR	Nonconducting material lacking a sufficient supply of free electrons to allow the movement of electrons without exceptional force or high voltage.
PIEZOELECTIC EFFECT	Process whereby emf is generated by pressure applied to a crystalline substance, usually Rochelle salts or quartz.
ELECTRODE	One of the metal parts of a battery.

(CONTINUES ON OTHER SIDE)

ELECTROLYTE	Solution capable of conducting electric current; the liquid part of a battery.
STATIC ELECTRICITY	Form of energy present when there are two charges of opposite polarity in close proximity. This type of electricity is generated by friction.
DRY CELL	Device that produces electricity through chemical action. Usually made of zinc and carbon with sal ammoniac as an electrolyte.
WET CELL	A term used to indicate that the cell can be recharged. Is another term for a secondary cell.
CIRCUIT	Pathway of conductors and devices designed for current flow.
CONDUCTOR	Solid, liquid, or gas that permits flow of electrons.
LODESTONE	Mineral with magnetic properties; a natural magnet.
RESISTOR	Device that opposes current flow.
ELECTROMAGNETISM	Magnetism produced by current flowing through a coil of wire or other conductor.
RELUCTANCE	The term used for resistance in magnetism.

ANSWER KEY

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #2

DIRECTIONS: Write each term next to the correct definition.

-Electromotive Force (emf)	-Volt	-Electrical Power	-Rheostat
-Ampere	-Kilovolt	-Watt	-Potentiometer
-Coulomb	-Megavolt	-Fixed Resistor	-Filament
-Milliampere	-Resistance	-Nichrome	-Incandescence
-Microampere	-Ohm	-Variable Resistor	-Inert Gas
-Power Rating	-Tolerance	-Ohm's Law	-Wattage Rating

MEGAVOLT	One million volts; MV.
VOLT	Unit of measurement of electromotive force; V.
OHM	Unit of measure for electrical resistance; abbreviated with Greek letter omega Ω.
POTENTIOMETER	Variable resistor that has three contact points.
RHEOSTAT	Variable resistor; usually has only two points connected into circuit. Used to control voltage by increasing and decreasing resistance.
ELECTROMOTIVE FORCE (EMF)	A term used to mean voltage.
AMPERE	Basic unit of electrical current. One is equal to 6.28×10^{18} electrons flowing past a given point in one second.
KILOVOLT	One thousand volts; kV.
COULOMB	Unit of measure for electrons at rest on a surface area.
MICROAMPERE	One-millionth of an ampere; abbreviated μA.
MILLIAMPERE	One-thousandth of an ampere; abbreviated mA.
RESISTANCE	Opposition to the movement of electrons; measured in ohms.
FILAMENT	Small coil of resistance wire in light bulbs and vacuum tubes that heats up to glow either red or white hot.
OHM'S LAW	Basic electrical law stating the relationships of voltage, current, and resistance; current in a circuit is equal to the voltage divided by the resistance.
WATT	Unit of electrical power abbreviated W.
NICHROME	A special alloy that is used as a resistance wire in resistors and heating elements.

(CONTINUES ON OTHER SIDE)

VARIABLE RESISTOR	A resistor so arranged so that a sliding middle contact can be moved to change the resistance desired.
FIXED RESISTOR	A resistor that has a fixed amount of resistance.
INERT GAS	A gas that will not react with other compounds.
TOLERANCE	The plus or minus allowances of a resistor or capacitor or any other device.
ELECTRICAL POWER	The energy required to push electrons through a resistance.
POWER RATING	The wattage rating of a device.
WATTAGE RATING	The unit of measure used to indicate how much heat electrical power a device can handle.
INCANDESCENCE	The white hot glow produced by a filament that is passing current.

ANSWER KEY

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #3

DIRECTIONS: Write each term next to the appropriate meaning.

	Omega	Coulomb
	Color code	Volt
	Tolerance	Ohm
	Milliampere	Kilo
	Wattage rating	Resistance

OMEGA	Symbol for resistance.
WATTAGE RATING	Power rating.
COLOR CODE	Used to tell the size of a resistor.
TOLERANCE	Plus or minus value.
VOLT	Unit of electrical pressure.
RESISTANCE	Opposition to electron movement.
KILO	One thousand.
COULOMB	6.28×10^{18} electrons.
OHM	Unit of resistance.
MILLIAMPERE	0.001 ampere.

ANSWER KEY

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #4

DIRECTIONS: Write each term next to the correct definition.

Power Supply	Fuse
Consuming Device	Series Circuit
Controlling Device	Electrical Load
Complete Circuit	Voltage Drop
Closed Circuit	Open Circuit
Short Circuit	

ELECTRICAL LOAD	Anything that consumes electrical energy.
POWER SUPPLY	Anything that will deliver electrical power.
CLOSED CIRCUIT	Any closed loop from a power source and back.
SHORT CIRCUIT	A circuit that has less resistance than intended.
CONSUMING DEVICE	Any electrical device that consumes power.
COMPLETE CIRCUIT	A circuit that has a complete path for electron flow from the battery or power source and back.
OPEN CIRCUIT	A circuit that does not have a complete path for electrons to flow from and back to the power source.
SERIES CIRCUIT	A circuit made up of two or more resistors or consuming devices connected one after the other or negative to positive.
FUSE	Safety device designed to open if an excess flows through the circuit.
VOLTAGE DROP	The same meaning as the terms voltage difference, emf, and electrical pressure. The amount of pressure or voltage dropped across a resistor or consuming device.
CONTROLLING DEVICE	Usually refers to a switch.

ANSWER KEY

Electricity and Electronics

Vocabulary Quiz # 5

DIRECTIONS: Write each word next to the appropriate meaning.

Circuit	Short circuit
Load	Complete circuit
Consuming device	Cell
Battery	Controlling device
Open circuit	

CONTROLLING DEVICE	Switch
CIRCUIT	Path for electrons.
CONSUMING DEVICE	Uses electrical power.
SHORT CIRCUIT	Has a path for electrons that is not through a load.
CELL	A device that generates electricity.
COMPLETE CIRCUIT	A circuit with a closed switch.
BATTERY	Two or more cells.
OPEN CIRCUIT	A circuit with no path for electrons to flow.
LOAD	Another name for a resistance.

ANSWER KEY

Electricity and Electronics

Vocabulary Quiz #6

DIRECTIONS: Write each term next to the appropriate meaning.

Reciprocal	Invert
Parallel circuit	Common denominator
R_T	

R_T	Total resistance.
COMMON DENOMINATOR	The bottom half of a fraction that several other fractions will divide into evenly.
PARALLEL CIRCUIT	Provides many paths for electrons to follow.
RECIPROCAL	The number 1 divided by another given number.
INVERT	To turn upside down.

ANSWER KEY

Electricity and Electronics

Vocabulary Quiz #7

DIRECTIONS: Write each term next to the correct definition.

Parallel circuit	Alternating current	Alternator	Average value
Reciprocal	Frequency	Waveform	rms Value
Direct current	Hertz (Hz)	Sine wave	Instant value
Polarity	Alternation	Peak value	Rectifier

POLARITY	Term for opposite positions and properties of electricity, such as negative or positive terminals of a battery or capacitor.
PARALLEL CIRCUIT	A circuit that has the load tapped off from the two power source leads and is connected positive to positive and negative to negative.
PEAK VALUE	The point at which the sine wave or any wave peaks or reaches its maximum point.
RECTIFIER	Device that changes AC to DC; allows current flow in only one direction.
FREQUENCY	Term describing the number of times an alternating current (AC) completes its cycle in one second.
WAVEFORM	Any configuration that varies at a given rate or frequency.
RECIPROCAL	Any number with a one over it.
HERTZ (Hz)	Unit of measurement of frequency; abbreviated Hz.
DIRECT CURRENT	Current that flows in one direction only; abbreviated DC.
ALTERNATOR	AC generator.
AVERAGE VALUE	The average of any number of value.
ALTERNATING CURRENT	Current that periodically changes magnitude and direction; abbreviated AC.
SINE WAVE	The signature of alternating current.
INSTANT VALUE	Any point along a sine wave that can be determined for use in finding the average or rms value.
rms VALUE	The root-means-square value. Equal to 0.707 of the peak value of a sine wave. Effective value.
ALTERNATION	The revolution of one-half of a sine wave.

ANSWER KEY

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #8

DIRECTIONS: Write each term next to the correct meaning.

Alternating current	Alternator
Hertz	Transformer
Frequency	Peak value
rms Value	Average value

TRANSFORMER	Used to change voltages.
HERTZ	Unit of measurement for frequency.
FREQUENCY	How often a sine wave is generated.
ALTERNATING CURRENT	Constantly changing in amplitude and direction.
PEAK VALUE	Point of maximum height on a sine wave.
rms VALUE	Effective value.
AVERAGE VALUE	Sum of the instantaneous values divided by the number of values.
ALTERNATOR	AC generator.

ANSWER KEY

Electricity and Electronics

Vocabulary Quiz #9

DIRECTIONS: Write each term next to the correct definition.

Inductance	Choke	Step-up transformer
Inductor	Inductive reactance	Turns ratio
Air-core inductor	Ballasts	Air-core transformer
Iron-core inductor	Step-down transformer	Capacitor
Dielectric	Capacitance	Farad
Electrolytic capacitor		Nonelectrolytic capacitor

INDUCTANCE	Property of a coil that opposes any change in circuit current; symbol is L. Measured in henrys.
BALLASTS	Choke or inductor used in a gaseous discharge, including flourescent, lamp circuit.
STEP-UP TRANSFORMER	A transformer that steps up the voltage from the primary to the secondary. Usually means a step down in the current available.
TURNS RATIO	The input to the output number of turns of a transformer. The ratio of the primary turns of a transformer to the secondary turns.
ELECTROLYTIC CAPACITOR	A capacitor that has polarity.
INDUCTOR	Device made by turns of insulated wire wound around a core.
CHOKE	Another name for a coil or inductor.
AIR-CORE TRANSFORMER	A transformer with no core. It is used in circuits where radio frequencies are present.
CAPACITANCE	Property of a capacitor that allows it to store an electric charge measured in farads (F).
FARAD	Unit of measurement; abbreviated F. Represents the the amount of capacitance needed to produce 1 ampere of current flow when a circuit has change of 1 volt per second.
IRON-CORE INDUCTOR	An inductor or choke that is designed to operate on audio frequencies.
INDUCTIVE REACTANCE	Opposition presented to alternating current by an inductor; symbol is X_L.
CAPACITOR	Device used to store an electric charge. Consists of two plates and a dielectric.

(CONTINUED ON OTHER SIDE)

DIELECTRIC	Insulating material used in a capacitor or other electrical device.
NONELECTROLYTIC CAPACITOR	A capacitor that does not have polarity.
AIR-CORE INDUCTOR	An inductor (coil or choke) that has no core. It is used in circuits where radio frequencies are present.
STEP-DOWN TRANSFORMER	A transformer that steps down the voltage from the primary to the secondary. Usually means a step up in the current available.

ANSWER KEY

ELECTRICITY AND ELECTRONICS

Vocabulary Quiz #10

DIRECTIONS: Write each term next to the correct definition.

Meter	Linear	Diode
Multimeter	Full-scale deflection	Taut-band movement
Deflect	Shunt	Iron vane meter
d'Arsonval meter movement	Voltmeter	Ohmmeter
Ammeter	Rectifier	Nonlinear

DEFLECT	To move aside.
LINEAR	Evenly spaced.
SHUNT	Means parallel. May be used to bypass current around a meter movement or any other device.
OHMMETER	Device used to measure electrical resistance in ohms.
METER	Instrument used to measure.
AMMETER	Device used to measure current in a circuit.
d'ARSONVAL METER MOVEMENT	Portion of meter consisting of fixed permanent magnet and moving electromagnetic coil.
TAUT-BAND MOVEMENT	A method used to suspend the moving coil of a DC meter movement.
NONLINEAR	A designation used to indicate that the spacing is not necessarily even.
VOLTMETER	Instrument used to measure voltage.
RECTIFIER	Device that changes AC to DC; allows current flow in only one direction.
DIODE	Device used to change AC to DC. Can either be vacuum tube or semiconductor.
MULTIMETER	A meter with several different scales used to measure several types of electrical units.
IRON VANE METER	A type of meter used to measure alternating current.
FULL-SCALE DEFLECTION	Refers to a meter's full-scale movement.

ANSWER KEY

Electricity and Electronics

Vocabulary Quiz #11

DIRECTIONS: Write each term next to the correct definition.

Vacuum tube	P-type material	PNP Transistor
Electronic circuits	Anode	NPN Transistor
Solid-state	Cathcode	Emitter
Doping	Avalanche breakdown	Base
N-type material	Transistor	Collector
	Common emitter circuit	

SOLID-STATE	Used to designate semiconductor material devices. The operating device is made of solid materials as opposed to the old vacuum tubes that had elements that did not touch.
AVALANCHE BREAKDOWN	The term used to describe the point where the zener diode starts to function as designed.
BASE	The middle connection on a transistor. It is the part sandwiched between the emitter and collector.
COLLECTOR	One of the three elements of a transistor.
VACUUM TUBE	A device designed to control the flow of current through an electronics circuit. It consists of two, three, or more elements spaced apart and mounted in a vacuum type container.
DOPING	The act of placing impurities in silicon or germanium to produce semiconductor devices.
CATHCODE	Part of a vacuum tube that emits electrons. May also be one terminal of a semiconductor diode, generally the point at which electrons enter the diode.
ELECTRONIC CIRCUITS	Circuits that use a semiconductor device or a vacuum tube.
P-TYPE MATERIAL	A semiconductor material that has a deficiency of electrons or excess holes.
N-TYPE MATERIAL	Semiconductor material that has an excess of electrons.
PNP TRANSISTOR	A transistor that has a positive, negative, positive arrangement of the semiconductor material.
NPN TRANSISTOR	A transistor that has its material aligned in a negative, positive, negative sequence.

CONTINUED ON OTHER SIDE

ANODE	Positive terminal of a device such as a vacuum tube, battery, or semiconductor diode.
TRANSISTOR	Semiconductor device used to amplify signals or for switching.
COMMON EMITTER CIRCUITS	A circuit using a transistor where the input is between the base and emitter and the output is taken from the emitter to the collector.
EMITTER	One of the elements of a transistor.

ANSWER KEY

Electricity and Electronics

Vocabulary Quiz #12

DIRECTIONS: Write each term next to the correct definition.

Diagonal cutting pliers	Side-cutter pliers	Allen wrench
Long-nose pliers	Wire stripper/cutter	Nut driver
Slip-joint pliers	Phillips-head screwdriver	Scratch awl
	Chassis punch	

WIRE STRIPPER/CUTTER	Tool used to remove insulation from a piece of wire.
NUT DRIVER	A device that looks like a screwdriver with a socket wrench on one end.
DIAGONAL CUTTING PLIERS	A tool that has cutting edges sharp enough to cut wires.
SLIP-JOINT PLIERS	Pliers that can be made to handle wider materials by slipping the hinge point slightly to allow for a wider opening.
CHASSIS PUNCH	A tool used to cut metal shapes out of radio and electronic project chassis.
PHILLIPS-HEAD SCREWDRIVER	A screwdriver that has a cross-shaped end to fit specially made screw heads.
ALLEN WRENCH	Wrenches are shafts of metal designed to slip into special screws.
LONG-NOSE PLIERS	A pair of pliers with long ends that can be used in tight situations.
SCRATCH AWL	An ice-pick type device used to scratch or score metal or wood.
SIDE-CUTTER PLIERS	Pliers, usually having heavy duty handles, with the ability to cut through heavy gage wire.

ANSWER KEY

Electricity and Electronics

Vocabulary Quiz #13

DIRECTIONS: Write each term next to the correct definition.

Solder	Acid-core flux	Tinning
Soldering Iron	Contact soldering	Cold solder joint
Flux	Dip soldering	Solder wick
Rosin-core flux	Wave soldering	Solder sucker
	Desoldering Iron	

DESOLDERING IRON	A device that is coupled with a soldering iron to remove unwanted solder.
WAVE SOLDERING	The type of soldering used by industry.
SOLDER	A combination of metals, usually tin and lead, used to join two components.
FLUX	A material used to prevent oxidation when a solder joint is heated sufficiently to melt solder.
ACID-CORE FLUX	Flux used in the solder is acid in nature.
DIP SOLDERING	In this type of soldering, the entire connection to be soldered is dipped into a pot of hot solder.
SOLDER WICK	A braided wire that, when heated, will absorb excess molten solder.
TINNING	The act of putting a coating of solder on the tip of a soldering iron or a coating on copper wire.
SOLDERING IRON	A tool used to melt solder to connect two pieces of metal.
COLD SOLDER JOINT	A solder joint that results when the metals to be soldered are not brought up to heat sufficient to melt the solder. Such a joint usually causes trouble later.
ROSIN-CORE FLUX	Flux that is made of a rosin and inserted as a core in solder used for electronic work.
SOLDER SUCKER	A device used to suck hot solder from a joint.
CONTACT SOLDERING	The type of soldering done with a soldering iron and solder wire applied by hand.